

SECTION 16702

TRAFFIC SIGNAL 2 PHASE CONTROLLER CABINET ASSEMBLIES AND CONFLICT  
MONITORS

PART I GENERAL

1.01 TERM OF AGREEMENT:

- A. The term of the agreement shall be for a 24 month period beginning on or about \_\_\_\_\_. During this period of time, purchase orders will be issued for the items needed. It is emphasized that the City of Houston does not guarantee to purchase any specific quantity of any item listed during the period of this agreement; rather, the quantities may vary depending upon the actual needs of the user Department.

1.02 TERM OF AGREEMENT:

- A. Bids shall be submitted in duplicate only on the Bid Form attached. Bidders are to complete and submit the A Information Sheet @, if attached. The right is reserved to accept or reject in whole or in part any or all bids received and to make an award(s) on the basis of individual item, combination of items, or overall best bid, as it is deemed in the best interest of the City.

1.03 FIRM PRICES ARE TO BE QUOTED FOR A 24-MONTH PERIOD.

1.04 MATERIALS:

- A. All items furnished under this contract shall be new/unused materials of the latest product in production to the commercial trade, and shall be of the highest quality as to materials used and workmanship. Manufacturer(s) furnishing these items shall be experienced in design and construction of such items and shall furnish evidence of having supplied similar items, which have been in successful operation, for not less than three years. The bidder shall be an established supplier of the items bid.

1.05 AUDIT:

- A. The City reserves all rights to review all payments made to Supplier(s)/

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Manufacturer(s) by auditing at a later date. Subject to audit, any overpayments may be recovered from the Supplier(s)/Manufacturer(s).

1.06 TERMINATION OF AGREEMENT:

- A. This contract may be terminated by the City, at its option, upon fifteen (15) days notice in writing, if the materials furnished do not conform to the standard set forth herein; or if the deliveries and servicing of this contract does not conform to the requirements detailed herein.

1.07 SILENCE OF SPECIFICATIONS:

- A. The apparent silence of these specifications as to any detail, or the apparent omission from it of a detailed description concerning any point, shall be regarded as meaning that only the best commercial practice is to prevail and that only material and workmanship of the finest quality are to be used. All interpretations of these specifications shall be made on the basis of this statement.

1.08 DELIVERY:

- A. The Supplier(s)/Manufacturer(s) agrees to make deliveries, only upon receipt of duly signed and approved purchase orders issued by the City of Houston Purchasing Agent. Delivery made without such purchase order shall be at Supplier(s)/Manufacturer(s) risk and shall leave the City the option of canceling any contract implied or expressed. Items requested for delivery are expected to be ordered in quantities of \_\_\_\_\_, unless placed order is less than above referenced quantities due to quantity bid, emergency needs, or funding restraints.

Total delivery time shall not exceed forty-five (45) days after receipt of quantity specific purchase order. All items shall be shipped (after sample approval and fabrication) FOB-Destination, Freight Prepaid to Delivery Address designated on Purchase Order.

Delivery shall be made between the hours of 8:00 a.m. to 3:00 p.m., on Monday through Friday, except City holidays. Receipt of deliveries on the City of Houston loading dock are subject to inspection/testing/acceptance by the City of Houston.

Controller cabinet assemblies shall be delivered in corrugated paper containers. Side and top of containers shall be marked with information as follows:

- (1) City of Houston
- (2) Manufacturer 's Name and Plant Location

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- (3) Date of Manufacturer  
(4) City of Houston Purchase Order No.

1.09 INSURANCE AND INDEMNIFICATION:

- A. Supplier(s)/Manufacturer(s) shall indemnify and save harmless the City from and against any and all lost and damage to City property and all claims, demands, losses and liabilities in any way resulting from or arising out of the performance of this Contract, whether or not damage, loss or liability results solely from the negligence of the Contractor, its employees or subcontractors; and provided that this indemnify clause shall not apply if the damage, loss or liability results solely from the negligence tort of City employees; and provided further, that any insurance proceeds paid for any damage, loss or liability covered by this indemnify clause, which monies are actually paid to the City, will be deducted from the amount the Supplier(s)/Manufacturer(s) may owe the City under this clause.

Should the Supplier(s)/Manufacturer(s) fail to indemnify the City in full for any damage, loss or liability under this clause, the City reserves the right to deduct the sum owed to the City from the payment specified in the Bidding Documents at all times when this Contract is in effect.

1.10 LIQUIDATED DAMAGES FOR LATE DELIVERY:

- A. Time is of the essence in this Contract and accordingly all time limits shall be strictly construed and rigidly enforced. The materials shall be furnished and fully delivered within the delivery time specified in the Bid Proposal and Purchase Order to be furnished to the Supplier(s)/Manufacturer(s) by the City. City and Supplier(s)/Manufacturer(s) agree that the City will suffer damages if the Supplier(s)/Manufacturer(s) fails to provide the material at the exact time and location specified by the City in accordance with this Contract and that the amount of damages will be difficult or impossible to determine. In order to provide a reasonable mechanism to compensate to the City for its damages, the Supplier(s)/Manufacturer(s) agrees to pay, or credit against any amounts due to the Supplier(s)/Manufacturer(s) from the City under this Contract one-half (1/2) of one (1) percent per day of the total dollar amount of late delivery items in the subject order for all days in excess of the specified number of days for delivery.

Computation of late delivery charges will commence the day following specified delivery date and will end the day of actual delivery less one (1) day. The number of these days times the dollar value of the items times 0.005 will equal the dollar value of liquidated damages to be deducted by the City from amounts owed to the Supplier(s)/Manufacturer(s).

1.11 WARRANTIES AND GUARANTEES:

- A. All material, workmanship and labor furnished shall be covered by Supplier(s)/Manufacturer(s) guarantee and/or warranty for a minimum period of thirty-six (36) months, or the Supplier(s)/Manufacturer(s) standard warranty, for whichever period is greater commencing on date of cabinet component installation in field. Supplier(s)/Manufacturer(s) shall include a post card addressed to Supplier(s)/Manufacturer(s) with each cabinet which will be completed by City for return to Supplier(s)/Manufacturer(s) with installation date, cabinet serial number, purchase order number and other information as appropriate to properly document beginning of warranty period. Warranty period shall begin the day the City officially installs the item for traffic control purposes. Any warranty work shall be completed within fifteen (15) days after receipt of notice of material deficiencies.
1. Successful bidder shall bear all expenses connected with return of any material which the City deems necessary to return for adjustments during guarantee period.
  2. The City of Houston reserves the right to withhold payments which may be due, should it be discovered that material does not meet specifications and/or claims of bidder.
  3. Supplier(s)/Manufacturer(s) shall make all engineering data, diagrams, software changes or improvements, which increases performance of equipment purchased under this bid, available to the City of Houston at no additional cost.
  4. Supplier(s)/Manufacturer(s) shall have field engineers or technicians available on request to assure satisfactory initial operation, and to consult with City's Traffic Engineer, or his representative, on any special circuitry that may be required in certain applications.

1.12 SPECIAL NOTICES:

- A. The City of Houston requests that the bidders shall furnish within thirty (30) days of notification of this contract from Material Management Division, one (1) cabinet ready for installation. Sample shall be used for testing, evaluation of system and operational function, to detect wiring errors in the cabinet design, and to suggest changes in layout of the wiring/cabinet to better accommodate City's requirements.

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Failure to comply within fifteen (15) days of written request for suggested changes shall be just cause for rejection of bid from further bid award consideration. Sample controller and testing, etc. will be completed as expeditiously as possible for return of the controller samples to the firm(s), which submitted such controller.

Sample is to be sent to:

Public Works and Engineering Department  
Traffic Management and Maintenance Division  
Attention: David Worley  
Phone # (713) 881-3174

## PART II PRODUCTS

### A. GENERAL DESIGN REQUIREMENTS

#### I. COMPONENTS:

##### Coordination Panels:

A coordination panel that will allow operations as a master or secondary for any given application shall be operator and jumper-program selectable. All I/O connections shall be brought to a terminal strip on the coordination panel and be clearly identified by function. The entire panel shall be readily replaceable in the field for maintenance purpose using common tools. Six (6) relay bases for master operation and six(6) relays for secondary operation with fully wired positions shall be provided on the coordination panel to interface coordination inputs (1) through (6) to the external 120 VAC conventional interconnect cable. Six (1-6) one-six relay bases for secondary operation will also need to be installed. Master relays will have 24VDC coils, secondary relays with 120 VAC coils. Relays used shall be plug-in Potter Brumfield K10P series/Magnecraft W-78 series or equivalent. Each cabinet will be supplied with one set of master relays and one set of secondary relays. Each relay position will be marked with its function ACYCLE 2, CYCLE 3, OFFSET 1, OFFSET 2, SPLIT 2, and one (1) spare that can be used for multiple functions@. It shall not be necessary to make any wiring changes other than the addition of a master/secondary jumper in order to change from secondary to master operation. The six (6) coordination I/O functions will be bused by a three (3) Ampere SLO- BLO fuse located on a six (6) position open type fuse block. The fuse block will be mounted on the same coordination panel. This panel will be mounted on the upper right inside cabinet wall. There shall be a terminal provided on

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the panel for the interconnect common wire labeled AINTERCONNECT COMMON@. There shall also be a computer on-line input which will cause the controller to ignore both hardwired and TBC commands. This input will be utilized for on-line computer control. This input will also be connected to a switch on the coordination panel that will release the controller to operate in an isolated manner. The switch shall be labeled one side FREE the other side COORDINATION. A terminal block with positions for the preempt connections and communications hook-up will also need to be placed on this panel. Each cabinet will come with all relays. This shall be accomplished through the BIU per NEMA No.TS2-1992 Specifications.

One standard RJ-11 modular telephone jack for two-way voice communication equipment shall be installed on the interconnect/preempt panel. The jack shall be securely mounted on the interconnect /preempt panel and shall be clearly marked via silk-screening as to function. All necessary wiring and incidentals required to connect this jack to one or two pair of wires on the lightning protection module installed in the communications compartment shall be provided.

One communications panel shall be mounted on the back wall of the side compartment. This panel shall contain the following: One (1) 66 M punch down block with 50 pairs of double clips, Siemens 842 or equivalent, one (1) lightning protection module (GAAS tube type) capable of protecting 4 pairs of cables (eight screw-type terminations shall be provided on each side of the protection module). Terminal numbers shall be clearly and permanently silk-screened on the panel adjacent to the terminal. Additional space (6@ x 9@) shall be reserved on the panel for installation of an external modem to be supplied by others. One EIA RS-232 DB-25 cable shall be provided for connection between the traffic signal controller and the external modem. This cable shall be provided with a EIA RS232 DB-25 male connection on the controller end and a female connection on the modem end.

Modem utilized in design with traffic signal controllers shall be external and Hayes compatible and conform with one of AT&T modem specifications as follows; 202S, 212, 212A, 201B, 201C, 208A, 209. Modems shall communicate at data rates of 1200, 2400, 4800, or 9600 bits per second (bps). Line drivers will be applicable with full duplex, 4-wire, capable of transceiving 19200 bps over a #19 awg twisted pair for six (6) miles.

## 2. MECHANICAL CONSTRUCTION:

All mechanical construction shall meet NEMA No. TS2-1992.

The power panel shall be mounted separately in the cabinet, not attached to the back panel, and it should be mounted as to not hinder the dropping of the back panel.

The two (2) phase field panel size shall be minimum ten inches (10@) wide x eighteen inches (18@) height mounted on the lower left side of the cabinet six (6) inches from the bottom with three (3) twenty-four (24) point terminal blocks mounted vertical one-and-a-half inches (1-1/2@) apart. Two (2) twelve (12) position grounding bars isolated from the chassis must be installed.

3. OUTDOOR TYPE CABINET:

- A. Controller and its housing shall be furnished to mount conveniently in an outdoor type aluminum cabinet in conformance with NEMA No. TS-2-1992 Environmental and Physical Standards, Sections 2 and 3.
- B. Cabinet shall be of clean-cut design and appearance. The cabinet shall be 49@Hx40@Wx18@D measurement. The cabinet shall have a dual purpose design and be of solid construction. (1) Cabinet shall provide a section for housing the controller and all associated electrical devices with approximate interior dimensions, 49@Hx30@Wx18@D. (2) Cabinet shall provide an isolated section within for housing meter service disconnect with approximate interior dimensions, 49@Hx10@Wx18@D. Two hinged doors shall be provided permitting complete access to each section of cabinet. One hinged door shall be provided for access to controller cabinet equipment. This shall be the main cabinet door. One hinged door shall be provided for access to meter service disconnect. This shall be located on the left side of cabinet. When closed, both doors shall fit closely to gasket material, thereby making cabinet weather-resistant and dust tight. Both doors shall be provided with Corbin No.2 lock and a stainless steel handle with a 5/8@ (minimum) shaft and a three point latch. The lock and latch design shall be such that the handle cannot be released until the lock is released. Two (2) keys shall be provided for each cabinet. Door hinges and pins shall be of corrosion resistant materials. The door shall be capable of being padlocked in the closed position. Reference City of Houston Drawing #SD549 and #SD548. The cabinet door handle shall be removable and shall be stored in a small compartment behind the police door. The police door shall be accessible with a standard police key.
- C. Cabinet shall be designed for ground mounting on a concrete foundation and shall be constructed of sheet aluminum, minimum 0.125@ inch

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thickness.

- D. Cabinet shall contain two shelves that adjust vertically. The top shelf shall have a minimum of 14" of vertical clearance. Depth of shelves shall be minimum of 10.5 inches. A blank panel 0.125" inch thick with dimensions of 14"Wx24"H shall be provided and secured in isolated section of cabinet. Blank panel shall be secured by two (2) vertical unistrut channels attached to cabinet on 12" inch centers extending from top to bottom of interior isolated section.
- E. Electrical connections from control units to outgoing and incoming circuits shall be made in such manner that controller may be replaced with a similar unit, without necessity of disconnecting and reconnecting individual wires. Unit replacements shall be accomplished by inserting multi-terminal connectors into receptacles incorporated into the control units.
- F. A thermostatically controlled electric fan/blower unit of minimum 100/cubic feet per minute capacity shall be installed to provide forced cabinet ventilation per NEMA No. TS2-1992. Thermostat and filter minimum TS2-1992. Standard off the shelf commercial fiberglass dry filters shall be used to cover all air intakes into the cabinet. (Minimum size (15"x20"x1/2" or equal surface area).
- G. An auxiliary cabinet door shall be provided in main cabinet door with access into auxiliary door through a conventional police lock and key.
- H. Behind the auxiliary door, there shall be manual push button switch cord, and a panel containing a flash-auto switch and auto-manual switch. **NOTE:** Main power switch shall not be installed in this panel.
- I. Cabinet shall contain a 20-watt fluorescent fixture complete with lamp to provide illumination and shall be activated by a door switch.
- J. The back panel shall be hinged at the bottom and shall fold out from the top for maintenance with all components (load switches, relays, etc.) in place. It shall be possible to gain full access to panel back in less than two (2) minutes using simple tools. Wire termination points on the back of panel shall be numbered or identified to correspond to labeling on front of panel. No printed circuits on back of panel shall be permitted, and no components shall be mounted behind back panel, except for RC filter networks for relay coils. Bottom edge of back panel shall be minimum six (6) inches above the base of cabinet.
- K. Cabinets shall be designed to mount with a four (4) bolt pattern. The



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mounting holes will be slotted and inside of cabinet.

- L. Load switch wiring shall be such that a load switch can be assigned to another phase with only minor wiring changes, such as changing wiring jumper connections.
  - M. Each cabinet shall be furnished with a base light relay wired to auxiliary circuit breaker. Contacts in the base light relay shall be rated for no less than 10 amperes and minimum of two (2) contacts.
  - N. A Ground Fault Circuit Interruption (GFCI) type duplex receptacle shall be mounted and wired to load side of 20-ampere circuit breaker.
  - O. A 50 ampere, minimum mercury wetted, relay shall be wired between RFI filter output and load switch power buss, and shall be controlled by signal and flash switch.
  - P. Transfer relays shall be plug-in type with contacts rated at 20 ampere, Magnecraft W21ACPX-2 or Midtex 136-62TA1 per NEMA no. TS2-1992 Section 6.4 (or approved equal).
4. SOLID STATE SIGNAL LIGHT SWITCHING ASSEMBLIES:
- A. Solid state load switches shall meet or exceed requirements set forth in NEMA Standards Publication No. TS2-1992.
  - B. There shall be sufficient load switches supplied to accommodate all functions and overlaps specified in Operating Characteristics, Section XV., of this Specification. For controllers, minimum number of load switches to be supplied shall be as follows.

**TERMINAL AND FACILITIES PANEL NUMBER OF LOAD SWITCHES**

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No. of Phases	Single	Overlap	Pedestrian	Total
2	2	0	2	4

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- C. Load switch bays shall be designed so that load switches will not cause conflict monitor to be operative in flashing mode if signal lamp load is lost due to lamp outage in a green, yellow, or walk signals.

5. SIGNAL MONITOR UNIT:

- A. Unit shall meet all environmental and physical requirements per NEMA No. TS2-1992 Section 4. Unit shall also be TS1-1989 compatible.
- B. Electro-mechanical output relay(s) shall be normally energized in A fail safe@ condition to monitor D.C. outputs. Unit shall accomplish NEMA Plus features with LED Backlit Display.
- C. Input to signal conflict monitor shall be available at a terminal that will enable monitor to be reset through use of external circuitry at discretion of city personnel.
- D. Conflict monitor shall conform to NEMA standard for conflict monitors currently in effect at time of purchase. Controller shall use monitor channels as follows:

NUMBER OF CONTROLLER PHASES    NUMBER OF MONITOR CHANNELS

2	12	TS1-1989
2	16	TS2-1992

- E. Unit shall communicate per RS485 Port 1 Connector NEMA No. TS2-1992 Section 4.

6. SIGNAL SHUTDOWN SWITCH

Omit the signal shutdown switch.

7. POWER CIRCUIT BREAKERS:

- A. Circuit breakers shall be furnished as follows: (Or approved equal)

- 1. Controller and Signal Circuits – one Square D. QOU140 40-

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ampere, single pole, to terminate No. 2 service wire, mounted and wired in cabinet.

2. Flash, Baselight and Fan/Blower – one Square D. QOU120 20-ampere, single pole, to terminate No. 2 service wire, mounted adjacent to 40 ampere breaker.
3. Street Lights - one Square D. QOU120 20-ampere, single pole, to terminate No. 2 service wire, mounted adjacent to other 20-ampere breaker.

- B. Above circuit breakers are in addition to any auxiliary fuses which are furnished with controller to protect component parts; i.e. transformer, transistors, etc.
  - C. An SHP 300-10 lightning-protecting device shall be furnished and installed on line side of circuit breakers per manufacturer's instructions. (An equivalent two (2) stage protection device may be used.) A clear shielded cover shall be placed over the lightning device.
8. INDEPENDENT FLASHER:
- A. An independent solid state flasher complete with radio interference suppresor rated at 50 amperes, with minimum attenuation of 50 decibels from 200 Kh to 75 Mh, and manual flash switch shall be installed and completely wired in cabinet to flash signals on all phases independent of all other traffic signal controls.
  - B. Flashing signal indications shall be at the rate of not less than 50 nor more than 60 flashes per minute with approximately 50 percent on and 50 percent off periods. Flasher shall have two (2) independent flash circuits with total capacity to switch 2000 watts of tungsten lamp load at 120 volts, 60 hertz. The first flash circuit shall flash phase one (1). The second flash circuit shall flash phase two (2).
  - C. Flasher shall meet requirements of NEMA Standards Publication TS2 - 1992 Section 6.3.
  - D. Transfer relays shall be plug-in type with contacts rated at 20 amperes, Magnecraft W21CPX-2 or Midtex 136-62T3A1 per NEMA No. TS2-1992, or approved equal.

9. TEST SWITCH:

Test switch shall be wired to energize control-timing circuits while signal lights are flashed by maintenance personnel. Test switch shall not be installed in police/auxiliary panel compartment.

10. WIRES AND INSULATION:

- A. Except where soldered terminal only is provided, all wires shall be provided with soldered lugs or other approved terminal fittings, Thomas & Betts or equivalent, for attachment to binding screws on terminal blocks. Insulation for parts and wire shall be of suitable material and insulated for 600VAC.
- B. Where cable or wire must be clamped to walls of cabinet to prevent wear or flexing, such clamps shall be of plastic or suitable metallic clamps with non-conducting coating materials.
- C. All wiring shall be neatly arranged and easily identifiable.
- D. All terminal block connections shall be separated by barriers.
- E. One #14 AWG wire shall be furnished for each load switch connected from load side of mercury relay to load switch AC+ buss.

11. TERMINALS:

- A. Controller, signal cable, interconnect cable, and detector terminals shall be installed in cabinet. All terminals designed to terminate signal cable shall be minimum #10 binding screws.
- B. Controller terminals shall be wired for all signal and interconnect circuits from controller to appropriate terminal blocks.
- C. Detector terminals shall be wired to detector circuits in controller connector plug(s).
- D. Two (2) each neutral (common) buses of minimum twelve (12) terminals for

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#10 wire shall be installed in convenient position to accept signal cable neutral wires. Reference City of Houston Drawing #SD550.

12. CARD RACK:

- A. Card Rack shall be Aplug-in@ version rack for two-channel or four-channel amplifier unit in lieu of two Channel units. Card Rack shall conform to NEMA TS2-1992, Section 2 of Section 6.5, latest revision, requirements for plug type, pin designations, and other applicable items.
- B. Card Rack shall be fabricated from 5052 aluminum alloy of 0.062 @ thickness, consisting of sides, top, bottom, and front panels of clear anodized aluminum; or alodine with sides, top and bottom having three rows of 1/4@x1@ ventilation holes.
- C. Card Rack shall be securely mounted to bottom shelf of cabinet and wired to accommodate eight (8) two-Channel digital loop detectors, or four (4) four-channel digital loops detectors.
- D. All detector channels shall be connected with separate twisted pair, shielded cable from card rack to field terminals for each individual loop.
- E. BIU shall accomplish this per NEMA No. TS2-1992.

13. DETECTOR TEST SWITCHES:

Toggle type test switches shall be installed on upper left side of cabinet to place manual calls on each vehicle and pedestrian phase. Toggle switches shall be three positions as follows:

<u>Switch Position</u>	<u>Function</u>
Up	Recall
Center	Normal Operation
Down	Momentary On

14. DETECTOR TERMINAL PANEL:

All loop lead in terminals shall have an EDCO Model SRA-6LC or approved equal lighting protection device wired in place per manufacturer(s) instructions or equivalent.

15. OPERATING CHARACTERISTICS:

Controllers shall function as described in NEMA Standards Publication TS2-1992 Type 2.

16. TIME BASE COORDINATOR:

An internal Time Base Coordinator shall be furnished in each controller per NEMA No.TS2-1992 Type 2.2

17. PREEMPTION:

All controllers shall be furnished with six (6) programmable functions for use with a Railroad, Fire, and or Emergency Traffic Control System.@

18. UNIFORM CODE FLASH:

All controllers shall be furnished with internal programmable flash sequencing functions conforming to current requirements of ATEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES@ and TS2- 1992 Section 3.9.

19. COMPUTER CAPABILITIES:

All controllers, and associated equipment shall be based upon digital computer and/or solid state device techniques and capabilities. All software, hardware, and programs necessary to operate, program, communicate, and access all data and functions shall be furnished per NEMA No. TS2-1992.

20. CITY OF HOUSTON INTERFACE PANEL, AND COMMUNICATION PORT:

A. Interconnect/Preempt Panel Interface:

This shall be accomplished via AA@, AB@ connectors per NEMA No.TS2-1992 Section 3.4.

B. Hardwire Interconnect:

Shall conform to NEMA No.TS2-1992 Section 8.5.5.2 Opto Inputs. Any scheme where the synchronization pulse is transmitted on a line separate from the offset selection lines is not acceptable.

C. External Download/Upload Interface:

1. The controller unit shall have an RS-232 serial port accessible through a DB-25S connector. The reserve connector pin assignments shall be as follows:

<u>Pin #</u>	<u>Designation</u>
1	Earth Ground
2	Transmit Data
3	Receive Data
4	Request to Send
5	Clear to Send
6	Not Used
7	Logic Ground
8	Data Carrier Detect
9-19	Not Used
20	Data Terminal Ready
21-25	Not Used

2. The baud rate of the port shall be keyboard or jumper selectable for any one of more the following rates: 9600, 1200, 2400, 4800, 7200, 9600, 19, 200

D. Adaptor Cable (57 Pin) Connector Pin Assignments:

<u>PIN</u>	<u>FUNCTION</u>	<u>PIN</u>	<u>FUNCTION</u>
1	OFFSET 1 IN	33	ALARM 1 IN
2	CYCLE 2 IN/TPA IN	34	ALARM 2 IN
3	CYCLE 3 IN /TPB IN	35	I/O MODE BIT A
4	FLASH IN (AUTO)	36	I/O MODE BIT B
5	OFFSET 2 IN	37	I/O MODE BIT C
6	OFFSET 3 IN	38	SPARE
7	INTERCONNECT FREE	39	ALARM 3 IN
8	SPLIT 2 IN/TPC IN	40	ALARM 4 IN
9	SPLIT 3 IN/TPD IN	41	ALARM 5 IN
10	SPECIAL FUNCTION 2 OUT (TBC)(AUX)	42	SPECIAL FUNCTION 3 OUT (TBC)(AUX)
11	COMPUTER ON-LINE/TBC ON LINE (TBC)(AUX)	43	SPECIAL FUNCTION 1 OUT

12	RESERVED B-U IN	44	SPLIT 3 OUT/TPD OUT
13	RESERVED B-S IN	45	SPLIT 2 OUT/TPC OUT
14	DIMMING ENABLE IN	46	INTERCONNECT FREE OUT
15	OFFSET 4 IN	47	OFFSET 3 OUT
16	OFFSET 4 OUT	48	OFFSET 2 OUT
17	MASTER SELECT	49	FLASH OUT (AUTO)
18	RESERVED	50	CYCLE 3 OUT/TPB OUT
19	PREEMPT 1 IN	51	CYCLE 2 OUT/TPA OUT
20	PREEMPT 2 IN	52	OFFSET 1 OUT
21	PREEMPT 3 IN	53	+24 V DC
22	PREEMPT 4 IN	54	LOGIC GND
23	PREEMPT 5 IN	55	CHASSIS GND
24	PREEMPT 6 IN	56	RESERVED A-u OUT
25	PREEMPT STATUS 1	57	RESERVED B-K OUT
26	PREEMPT STATUS 2		
27	PREEMPT STATUS 3		
28	PREEMPT STATUS 4		
29	PREEMPT STATUS 5		
30	PREEMPT STATUS 6		
31	SIGNAL PLAN A		
32	SIGNAL PLAN B		

21. WIRING DIAGRAMS AND OPERATING INSTRUCTIONS:

- A. Two (2) complete sets of wiring schematic drawings and panel layouts shall be furnished with each controller. These drawings shall be placed in a heavy-duty plastic envelope and securely attached to main cabinet door. Minimum envelope dimensions shall be nine (9) inches wide by twelve (12) inches deep, with self-closing side opening.
- B. Two (2) complete sets of reproducible film drawings shall be furnished for permanent record purposes.
- C. Complete sets of legible programming sheets shall be provided on disk per MSWORD format.
- D. One instruction manual per cabinet shall be furnished to the City. Manual(s) shall consist of operational and electrical/electronic specifications, timing procedures, circuit operation, engineering data, schematic wiring diagrams and charts, software description and printout, replacement parts lists, and all instruction necessary for installation and



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maintenance of the equipment. Manufacturer updated manuals, drawings, data, etc. Shall be furnished to City at no additional cost, within sixty (60) days from update releases by manufacturer.

22. TEST EQUIPMENT:

Supplier(s) Manufacturer(s) shall furnish any special test equipment that is necessary to install, operate or maintain the equipment.

23. ASSOCIATED EQUIPMENT:

Successful bidder(s) shall supply the following equipment on this contract.

- A. Successful bidder shall supply two (2) extender boards and two (2) data transfer cables for every fifty controllers provided on this contract with a minimum of two (2) each.
- B. One (1) set of software needed to perform all diagnostic test on the controller I/O, and all other associated operations.

24. TRAINING:

Manufacturer(s)/Supplier(s) shall conduct at least 2 (two) courses each consisting of forty (40) hours of technical training seminars for City of Houston personnel. Seminars shall provide informational and instructional guidance to City engineering and maintenance personnel in the installation, operation, maintenance, and repair of equipment furnished under this bid.

25. INSURANCE:

- A. If the performance of this Contract requires the Contractor or its subcontractor(s) to install, repair, deliver items on City property the Contractor shall carry and maintain throughout the period of this Contract Workmen=s Compensation Insurance as required by law, comprehensive general liability insurance, including contractual liability and comprehensive automobile liability insurance with a company or companies satisfactory to the City, and on policies that meet the requirements of the State of Texas. Such coverage shall have minimum limits of liability in not less than the following amount:
  - 1. Comprehensive general liability insurance including contractual liability:

Bodily injury:	\$1,000,000 per occurrence
Property damage:	\$1,000,000 per occurrence

2. Comprehensive automobile liability insurance:

Bodily injury	\$1,000,000 per person \$1,000,000 per occurrence
Property damage	\$1,000,000 per occurrence

- B. Prior to starting work, the Contractor must present to the City of Houston Purchasing Agent a Certificate of Insurance evidencing the insurance coverage specified above. This is a mandatory requirement. **ONLY UNALTERED ORIGINAL INSURANCE CERTIFICATES ENDORSED BY THE UNDERWRITER ARE ACCEPTABLE. PHOTOCOPIES ARE UNACCEPTABLE.**

26. SUPPLEMENTAL COVERAGE FOR PRODUCT LIABILITY:

Supplier(s)/Manufacturer(s) shall maintain in effect insurance coverage for Product Liability as follows:

A policy of Product Liability Insurance with a minimum limit of \$1,000,000 per occurrence through out the life of this contract.

END OF SECTION